DHI CASE STORY

CONTRIBUTING TO THE DANUBE ATLAS

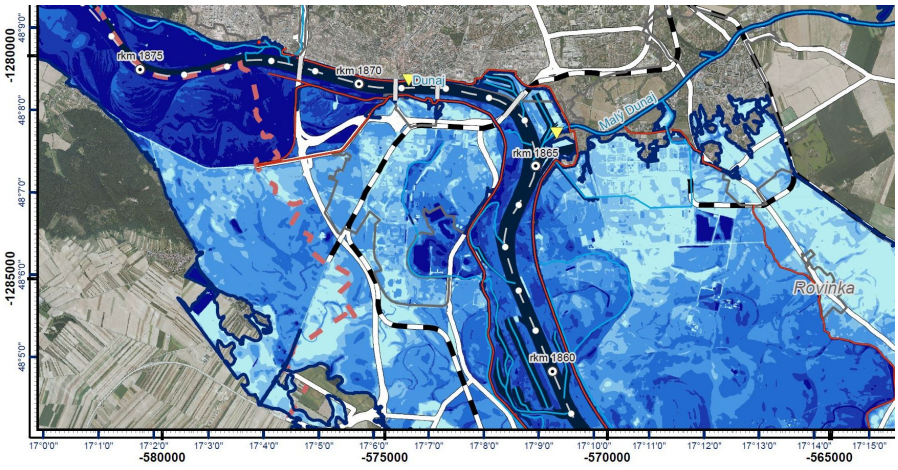
Modelling the Danube River's floodplains to update flood hazard and risk maps

Growing development along the Danube River in recent years means increasing damage to industries and cities in alongside it in the event of flooding. To help Slovakia improve flood management, we modelled current flood risks to urban areas along the river that are currently protected by dikes. This information was used to create flood hazard and risk maps of the Danube River, which were also included in the Europe-wide Danube Atlas.

PROTECTING AGAINST FLOODING ALONG THE DANUBE RIVER

The Danube is Europe's second longest river – on its way to the Black Sea, it flows through or along the border of ten countries. Over the years, the number of industries in the Danube's floodplains has increased. In addition, urban areas along the river are getting larger. As the risk of floods rises due to the impacts of climate change, this has led to the possibility of increased damage costs in the event of severe flooding.

Catastrophic flooding along the Danube caused by heavy rainfall and melting snow in 2006 highlighted this vulnerability. To help improve flood management along the river, eight Danube countries (Germany, Austria, Slovakia, Hungary, Croatia, the Republic of Serbia, Bulgaria and Romania) participated in the Danube Floodrisk project.



Flood hazard map list illustration of water depth (1,000 year return period discharge). Digital Terrain Model and Orthophotomap © Eurosense s.r.o. / Geodis Slovakia s.r.o. 2008-2011.

SUMMARY

CLIENT

Slovak Water Management Enterprise

CHALLENGE

Lack of up-to-date knowledge of flood hazards and risks along the Danube River within Slovakia

SOLUTION

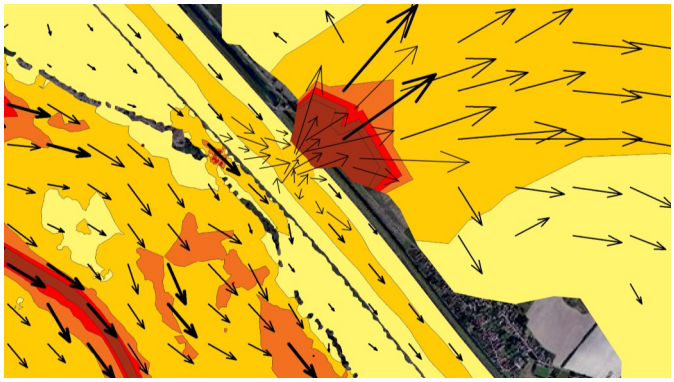
Two-dimensional (2D) hydrodynamic modelling of the entire 172 km stretch of the Danube River within Slovakia

VALUE

- Gained valuable new data that enabled the client to update of flood hazard and risk maps
- Enabled the client to contribute to the Europe-wide Danube Atlas – a book of flood hazard and risk maps for the entire Danube River

LOCATION / COUNTRY

Slovakia



Detail of the current speed map with vectors showing flow direction (1,000 year return period discharge). Digital Terrain Model and Orthophotomap © Eurosense s.r.o. / Geodis Slovakia s.r.o. 2008-2011.

Supported by the European Union´s Operation Programme South East Europe, the Danube Floodrisk project's goal was to help countries determine the most cost-effective measures to reduce flood risks. It focused on:

- risk assessment
- risk mapping
- stakeholder involvement
- risk reduction using adequate spatial planning

Although large areas along the Danube are protected against floods by dikes and flood walls, these structures should not be regarded as 100% reliable. If flood protection measures fail, damages can be significantly reduced by using appropriate preventive and operative measures. Planning of such measures requires knowledge about the possible extent of flooding, flooding depth, and evolution of flooding in time and space.

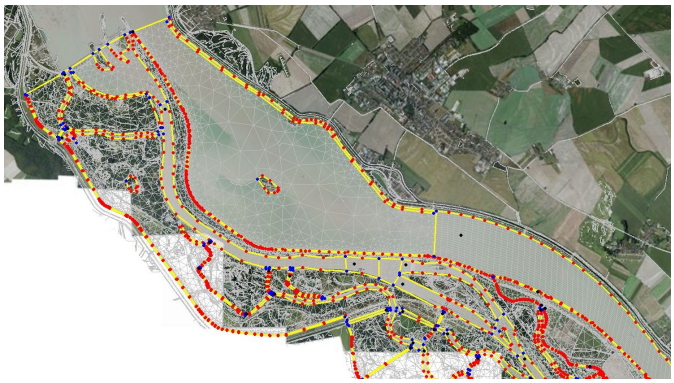
THE BENEFITS OF PARALLEL COMPUTING

The 2D model we ran for this project required long computational times – up to 80 days using a single processor computer. Instead, we utilised parallel computing, using an 8-core number cruncher computer to complete the simulation in just ten days. Taking advantage of the Graphics Processing Unit (GPU) computing technology now available today would lead to even faster results.

Parallel computing enables users to obtain flood development forecast results in a relatively short amount of time. This is especially valuable for modelling real-time flooding events, such as the threat of a dike breach.

CONTRIBUTING TO THE DANUBE ATLAS

As part of the Danube Floodrisk project, we modelled the Danube River's floodplains in Slovakia. We worked as a subcontractor to Slovak Water Management Enterprise. They asked us to conduct hydrodynamic modelling for a 172 km long stretch of the Danube as well as perform numerical simulations of various dike breach scenarios.



Detail of computational mesh. Digital Terrain Model and Orthophotomap © Eurosense s.r.o. / Geodis Slovakia s.r.o. 2008-2011.

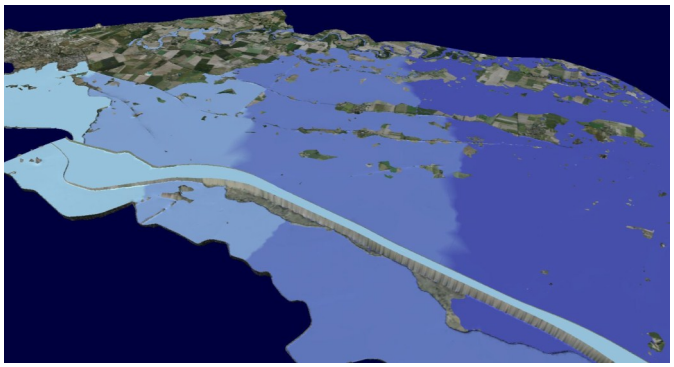
We have the experience and software needed to model these scenarios and the consequent flooding of large, flat, complex areas. For this project, we simulated the dike breach scenarios using a two-dimensional (2D) hydrodynamic model with our MIKE 21 FM with flexible mesh. The largest flooded populated area was approximately 90 x 20 km.

Locations along the Danube that flooded almost 50 years ago have since seen significant development. We used present conditions to simulate flooding in order to gain new data. By modelling unsteady flow flooding scenarios with duration of 20 days, we determined:

- the maximum extent of flooding
- flooding depth
- flow velocities

Our modelling results provided information about the possible flood threats in populated areas currently protected by dikes.

We also used the results of our numerical modelling to determine potential flood damages and the number of endangered inhabitants. This data helped raise awareness of the possible flood risks. The information also contributed to the creation of the Danube Atlas – a book of flood hazard and risk maps for the entire Danube River.



Range of flooded area (1,000 year return period discharge). Digital Terrain Model and Orthophotomap © Eurosense s.r.o. / Geodis Slovakia s.r.o. 2008-2011.

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